

Staff Meeting Bulletin
Hospitals of the . . .
University of Minnesota

Carcinoma of Colon

STAFF MEETING BULLETIN
HOSPITALS OF THE . . .
UNIVERSITY OF MINNESOTA

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William A. O'Brien, M.D.

I. LAST WEEK

Date: October 1, 1936
Place: Recreation Room, Nurses' Hall
Time: 12:15 to 1:21
Program: Movie: Living Jewels
 Case Report: Neurosarcoma of Small Bowel, Transfusion Reactions, Evisceration
Present: 85
Discussion: Rudolph Koucky
 A. L. Abraham
 Richard Johnson
 W. T. Peyton
 F. H. Crago
 O. H. Wangersteen
 E. E. Osgood
 (University of Oregon)

Errata: Newman, Harry R. - Toronto, Urology - instead of Neurology
 Crago, F. H. - Wheeling, West Virginia - instead of Craig, F. H.
 Gertrude Gunn,
 Record Librarian
 * * * * *

II. MOVIE

Title: Mountain Building
Released by: Erpi Film Corp.

* * * * *

III. ABSTRACT

CARCINOMA OF COLON

E. J. Semansky

Incidence

Carcinoma of the colon is being recognized more frequently. This fact may be attributed to the increased accuracy of

roentgenologic diagnosis and the more general employment of roentgenograms. In the period between 1900 and 1929 of all deaths from carcinoma in this country, deaths from carcinoma of the intestine showed the most pronounced increase. Carcinoma of the intestine (exclusive of the rectum) increased from 7.1 to 9.4% for each 100,000 population; carcinoma of the rectum increased from 3.2 to 4.2%. Similarly, in England and Wales during the same period, carcinoma of the intestinal tract increased from 6.8 to 13.6% and carcinoma of the rectum from 6.8 to 8.3% per 100,000 population. Azeman, et al, in a series of 7,000 necropsies, found 5,796 deaths from carcinoma in general and almost one-fourth of these carcinomas were of the intestinal tract.

The relative incidence of carcinoma of the colon is shown in the following table:

<u>Author</u>	<u>No. of Cases</u>		
	<u>Stomach</u>	<u>Small Bowel</u>	<u>Rec-tum</u>
Vienna Pathology Institute	--	18	164
Schleip	--	36	526
Judd	4,335	55	4,597

Location

The mobile terminal segments of the colon, cecum and sigmoid are most frequently invaded. Judd, in a series of carcinoma of the colon, gave the situation as follows:

Ascending colon and cecum	59
Hepatic flexure	29
Splenic flexure	24
Descending colon	46
Transverse colon	75
Sigmoid	292

In 297 cases reported by Korte, Pertmann and Onschitz, 47 were in the cecum, 22 in the ascending colon, 19 in the hepatic flexure, 44 in the transverse colon, 31 in the splenic flexure, 10 in the descending colon, and 124 in the sigmoid. Carcinoma of the right side of the colon is most often situat-

ed at the juncture of the hepatic flexures of the colon with the cecum rather than as is usually supposed, at the ileocecal valve. It is quite rare to find the ileocecal valve invaded unless the carcinoma is quite extensive and for this reason obstruction in such cases is absent or late in developing. Rankin, in 1923, reported 150 resections of the right half of the colon performed at the Mayo Clinic, and in this series 102 were in the cecum, 30 in the ascending colon, 50 in the hepatic flexure, 3 at the ascending colon, 15 in the hepatic flexure, and 3 at the juncture of the hepatic flexure with the transverse colon. The frequency with which carcinoma occurs at the splenic angle differs in statistics given by the various authors. DeBovis showed 4.9% in a large number of his cases to have occurred at the splenic flexure, although Madelung reported 12.8% from a total of 241 cases of carcinoma. These cases were originally reported by 7 different surgeons. Hartwell asserted that the flexure is the third most common site of carcinoma of the large intestine exclusive of the rectum.

Anatomy and Physiology

The large intestine is composed of cecum, appendix, ascending colon, transverse colon, descending colon, sigmoid flexure, rectosigmoid, rectum and anus. Developmentally, anatomically and physiologically, the colon is divided into a right and left half. The distinct functions of the two segments of the bowel and differences in types of malignant growths customarily found in each are of practical significance. The right half of the colon is the absorbing portion and is comparable in function to the small bowel with which it has a common embryological development. From the ampulla of Vater approximately to the middle of the transverse colon, the large intestine develops with the small intestine from the midgut, and the function of this whole division is one of digestion and absorption. Beyond the middle of the transverse colon, the large bowel develops from the hindgut and its duty is one of storage. The two halves also derive their blood supply from different sources: the superior mesenteric arteries supply

the digestive or absorptive portions and the inferior mesenteric arteries supply the distal half of the large bowel. The distribution of the lymphatic vessels of the large bowel is not uniform. The lymphatic supply of the cecum and appendix is out of proportion to that of the remainder of the large bowel. The rectum and two flexures of the transverse colon are next most richly supplied. The lymphatics arise from the plexuses in the wall of the intestine. The lymphatics in the transverse colon are better developed than those of the descending colon and are more numerous than that of the hepatic and splenic flexures.

Sex

Carcinoma of the large bowel is more common in males although Nothangel expressed the opinion that there is little difference in the relative frequency in the sexes. Vangerveir reported a series of cases in which 63.8% of the patients were males, 36.2% were females. Clogg reported 55 cases in which 29 were males and 26 were females. At the Mayo Clinic, the males have been affected in a proportion of approximately 2 to 1.

Age

Carcinoma of the colon may occur at any age although it is usually found in the 5th and 6th decades. Numerous cases have been reported between the 20th and 30th years and some even in the second decade. Obviously, age is no barrier to malignant disease of the colon. The origin of carcinoma of the colon like carcinoma elsewhere remains obscure although it has been fairly well established that in the presence of polypi, degeneration may take place and carcinomas arise in these instances. Rankin and Fitzgibbon, in 13 cases of polyposis of the colon, found malignant changes in all but 2. Age, sex and race factors appear to be no different than in other carcinomas. Peculiarities of geographic distribution are notable.

Pathology

Carcinoma of the colon may be conveniently classified according to its growth and microscopic anatomy as follows:

Soft medullary adenocarcinoma	51%
Scirrhotic or fibrocarcinoma	33%
Mucoid adenocarcinoma	15%

These different types are responsible for marked variations in symptoms as well as roentgenologic evidence. Carcinomas in the right half of the colon, as a rule, are large, bulky, ulcerating growths in marked contrast to the more scirrhotous, annular, encircling growths which tend to produce obstruction of the left half of the colon. These medullary carcinomas with irregular extensively exposed surfaces account for the wide variations in contour and extent of the filling defects, as noted roentgenoscopically, while the small, hard, annular fibrocarcinomas present a more constant and characteristic picture. Notwithstanding their tendency to become large fungating growths, medullary carcinomas situated in the right half of the colon do not tend to produce obstruction because of (1) the liquid nature of the fecal content in this segment, (2) the lack of tendency of the lesion to encircle the bowel, (3) the larger lumen of the right half of the colon. The growth is more likely to go on to penetration, perforation or formation of an abscess. On the other hand, at the distal segment of the large bowel, carcinomas usually originate close to the mesenteric border. They spread laterally, diminishing the size of the lumen and produce chronic, subacute or even acute intestinal obstruction. Bleeding is more frequently noted in growths of the left side of the colon because of the more solid nature of the fecal column. Prolonged and slow growth of carcinoma of the colon produces in some instances large masses which are situated in a dependent or mobile portion of the bowel and are subject to volvulus. Moreover, the bulky carcinomas common to the proximal colon may protrude into the lumen and by the telescoping of one segment into another produce intussusception. Eventually, regardless of the pathologic types, ulceration and secondary infection take place. This infection may result

in local abscesses, fistulous tracts or peritonitis. Perforation or extension of the growth through the intestinal wall is more likely to occur at a flexure than at some fixed portion of the bowel. Secondary complications due to invasion of contiguous structures may take place. Obstructing carcinomas produce dilation and hypertrophy of the intestine above the growth.

Metastasis

The lymphatics provide the principle mode of dissemination. The lymphatic system in all parts of the digestive tract follows well-defined lines and usually accompanies the regional blood vessels. The lymphatics of the cecum and appendix are more extensively developed than those of the other segments of the large intestine, yet metastasis from the cecum are among the slowest to develop of any segment of the large bowel. (The rich lymphatic supply serves as a defensive mechanism?) The different segments of the colon, excluding the rectum, in the order of frequency of metastasis are sigmoid, descending and transverse colon, hepatic flexure, splenic flexure and ascending colon. Nodes may grossly appear normal and yet microscopic sections may reveal malignancy.

Prognosis

The most important factor in prognosis in cancer of the colon is the growth activity of the neoplastic cells, particularly their ability to differentiate or not differentiate from the normal. Extrinsic factors or modifying factors which are of grave importance are general conditions of the host, such as age, co-existing debilitating diseases and duration and direction of the growth. To these may be added secondary factors which are the direct result of the presence of malignant neoplasms, such as anemia, loss of weight, glandular metastasis, as well as other factors local to the growth including fixation, perforation and other complications. Youth seems to be an unfavorable factor. In young individuals, the duration of

symptoms is usually shorter, the percentage of metastasis greater, the operability rate lower, the percentage of ultimate satisfactory cures after periods of 3 and 5 years greatly decreased. The total good results are approximately 50% less and the total ultimate results 20% less than in a group of patients of all ages taken together. The duration of the growth is difficult to estimate accurately. The average patient having a carcinoma of the colon will have symptoms approximately 10 months or more before seeking advice. The size of the growth has little, if anything, to do with the ultimate prognosis. The diameter of the growths removed from patients who obtained five year cures averaged up to the same size as those obtained from patients who died of recurrence. The presence or absence of glandular invasion to the surgeon is the best indication of prognosis and guide to management.

The following is the incidence of glandular involvement: (Note correlation with grade of malignancy)

Grade I carcinomas	27%
Grade II carcinomas	35
Grade III carcinomas	50
Grade IV carcinomas	56

When the lesion takes on polypoid characteristics, the lesion is usually of a low grade of malignancy and with little or no nodal involvement. When the lesion is a punched-out ulcer, it is more apt to be of a higher grade of malignancy with a larger percentage of nodal involvement. Rankin found in polypoid lesions the five-year cures numbered 62% against 41% with a small ulcerating type of lesion. Rankin analyzed 753 cases.

The grading, relation to metastasis and the outcome is shown in the following table:

<u>With glandular involvement</u>	387 cases	<u>Incidence %</u>	<u>5-yr. cures %</u>
Grade I		9	44
Grade II		51	34
Grade III		28	13
Grade IV		12	15

<u>Without glandular involvement</u>	466 cases	<u>Incidence %</u>	<u>5-yr. cures %</u>
Grade I		16	69
Grade II		62	56
Grade III		16	49
Grade IV		6	37

The prognosis for the two halves of the colon are shown in the following tables:

	<u>Incidence %</u>
Right half of colon with nodal involvement	34
Five-year cures " " "	39
Cures without nodal involvement	66
Left half of colon with nodal involvement	31
Five year cures " " "	29
Cures without nodal involvement	55

Grading of malignancy in relation to postoperative length of life:

	<u>Incidence %</u>	<u>5-yr. cures %</u>
Right side of colon		
Grade I	16	68
Grade II	53	60
Grade III	21	48
Grade IV	10	34
Left side of colon		
Grade I	13	63
Grade II	67	51
Grade III	16	30
Grade IV	4	18

Relation of gradings of five-year cures (2 sides combined):

	<u>Incidence %</u>
Grade I	63
Grade II	51
Grade III	31
Grade IV	24

Symptoms

The onset of symptoms is insidious but on rare occasions may occur with explosive suddenness. There are a few characteristic early symptoms: a warning ordinarily is given by a change of bowel habits or some irregularity of the bowel, such as a diarrhea or periods of constipation. Approximately 95% of carcinomas of the entire colon present no more definite symptoms in the early stages of the disease. The diarrhea is usually slight and irritating and may alternate with periods of constipation. The direct question as to the number of stools each day may or may not elicit this information accurately for a patient often overlooks these irregularities. Gastric symptoms are occasionally associated with colonic disease such as impaired appetite and indigestion without loss of weight. In lesions of the left half of the colon, gastric symptoms may be the first of which the patient complains. DeBovis divided the symptoms, as determined in his series, into the following groups with their relative order of frequency.

Constipation	37.2%
Alternating constipation and diarrhea	20.6
Diarrhea	13.6
Occlusion	12.1
Pain	9.8
Dyspepsia	3.2
Negative or objective	2.9

Borborygmi and increased peristaltic movements are usually the early symptoms about which the patient seeks advice. These signs indicate impending obstruction. The fulminating type of obstruction which comes on without warning occurs in about 5% of carcinoma of the colon without any previous history suggesting carcinoma as a possibility. Thirty-five percent of the patients with carcinomas involving the large bowel present a picture of an acute intestinal obstruction but in these individuals a definite preceding history can be elicited. The duration of symptoms from carcinoma in all parts of the colon averages about 15 months. It is shorter in cases in which the mass is easily detected or in which the predilection to complication is more marked. The average

duration in the cecum is shorter (6 to 7 months according to Holman).

Symptoms of carcinoma involving the right half of the colon:

In this segment of the bowel, the large fungating ulcerating growths occur on the lateral wall and present a large ulcerating surface giving rise to profound intoxication and anemia without a tendency to produce any obstruction. In this portion of the colon likewise the fecal current is liquid and profoundly septic and the permeability of the wall of the bowel is markedly increased. The wall of the bowel becomes porous so that organisms readily penetrate its coats and become potential factors in peritonitis. In most cases, symptoms of carcinoma in the right half of the colon are classified under three groups:

- (1) so-called dyspepsia, mild in character, with a few localizing symptoms and usually diagnosed as chronic appendicitis or chronic cholecystitis;
- (2) profound anemia, loss of weight and loss of strength;
- (3) a mass accidentally discovered in the right iliac fossa which on further investigation will prove to be a neoplasm.

Pain is infrequently an early symptom and when present usually is not significant. Probably because of the nature of the nerve supply of the large intestine, the pain when in evidence rarely is at the site of the lesion. It is often referred to the epigastrium. Blood found in the stool may have its origin in any portion of the alimentary canal. If it is bright blood and persists in the stool, unquestionably a local lesion is present which is distal to the splenic flexure. Eighty to 90% of the lesions in the left colon have gross bleeding but gross blood in the stool rarely is noted when the growth is in the right half of the colon. The shape and character of the stool are of little significance in malignancy of the right half of the colon. Normal

stools may be expected since the liquid or semi-fluid fecal material pass by the stenosis. Obstruction may be acute, subacute or chronic. Acute obstruction is produced by volvulus, intussusception or sudden plugging of a partially stenosed lumen. Pain and local tenderness simulating subacute or chronic appendicitis without a tendency to disappear occasionally are early signs of cecal carcinoma.

In the second group, that is, of anemia, weakness and loss of weight, one factor is usually outstanding; namely, the profound anemia with concomitant decrease in hemoglobin without any visible loss of blood. Attention may be called to such anemia by the patient's inability to carry on his work or by unexplained weakness or may be found on examination without any apparent cause. This marked anemia may be due to direct and slow loss of blood but may be due in part to some perverted or inhibited function of the mucous membrane which impairs it to such an extent that absorption of toxins through the broad infected surface that the growth occurs. The hemoglobin content may drop below 30%. Operations on the right half of the colon may be carried out even in the face of such severe anemias. The intoxication and weakness are in direct proportion to the size of the neoplasm and the degree of ulceration and secondary infection present, and these factors rather than obstruction influence the symptoms. In the hepatic angle of the colon, the presence of malignancy is influenced by the same factors as in the lower right half of the same segment. The close proximity of this segment to the duodenum and biliary apparatus makes for easy attachment of adjacent viscera and the likelihood of complications. In the transverse colon, the mobility of the bowel permits the tumefaction to alter its position of the abdomen. The content of the bowel in this segment ranges from a liquid or semi-solid to a solid one as it approaches the splenic flexure and for this reason carcinoma of the transverse colon may resemble symptomatically the right or the left half of the large bowel or present a combination of both. Obstruction takes place in the left half of the transverse colon with moderate frequency. Complications in the transverse colon are not

unusual and attachments of carcinoma of this segment to contiguous structures, namely the stomach, are found sufficiently often to be worthy of mention.

Symptoms of the left half of the colon

The syndrome of neoplastic growths of the left half of the colon is evidenced more by acute, subacute or chronic symptoms of obstruction than by physiologic disturbances. Each type of growth which involves the left half of the colon tends to encircle the lumen of the bowel and this with the hard formed fecal content of the left half of the colon and its anatomic makeup all predispose to obstruction. Visible or painful peristaltic movements associated with increased flatulence are the early signs. Progressive constipation occurs in a high proportion of cases (between 25 and 40%) and should call attention to the presence of some mechanical stenosis. Obstruction may be acute (5%) or chronic. The obstruction when acute may be due to volvulus, intussusception, plugging of the lumen of the bowel by a foreign body or to edema due to an inflammatory process superimposed on the malignant condition. The chronic form of obstruction occurs in a considerable number of cases of carcinoma of the colon due to direct encroachment on the lumen of the bowel. Unless the acute obstruction is relieved, a serious condition is imposed on the chronic malignant state demanding immediate intervention and the exercise of extremely careful surgical judgment. In the splenic flexure, obstruction of a chronic or an acute variety develops in practically 100% of cases. The anatomic situation of this flexure, its costal protection and high fixation increase the difficulty of diagnosing lesions at this point. The tendency to perforation and formation of abscesses in this segment is quite common. In carcinomas involving the splenic flexure, particularly in young individuals, a syndrome frequently develops which is referable to the right side of the abdomen. Pain, muscle spasm and tenderness may be referred to the right quadrant and may be diagnosed as acute appendicitis, pancreatitis or cholecystitis.

Summary of symptoms

Right Half

1. Cellular carcinomas presenting large, raw, ulcerating and therefore bleeding surfaces occur here more frequently than in other segments.
2. Attacks of mild dyspepsia with a few local symptoms usually diagnosed as intestinal indigestion or chronic appendicitis are present in a large percentage of these cases before localizing symptoms make diagnosis certain.
3. Pain or local tenderness simulating acute appendicitis and without tendency to entirely disappear is frequently an early symptom.
4. The fecal current is liquid, there is a lack of tendency to encircle the bowel, the lumen of which is greater than elsewhere so that obstruction is not common. There is a likelihood that the growth will go on to perforation, penetration or formation of abscess.
5. Intermittent diarrhea with periods of normal bowel movements and without a tendency to constipation is frequent.
6. Weakness without an explainable cause but accompanied by mild intestinal symptoms should call for investigation of the colon.
7. Anemia without visible loss of blood is one of the early symptoms. This is true in such a high percentage of cases that malignancy of the cecum should be suspected and ruled out by roentgenologic examination in any case presenting secondary anemia without definite explainable cause.
8. Tumefaction occurs relatively early in this segment and its accidental discovery occasionally calls attention to the presence of a carcinoma before other symptoms manifest themselves.
9. Acute obstruction is rare in this segment. Chronic obstruction scarcely ever is observed.

10. Loss of weight and cachexia are unimportant symptoms of malignancy of the right half of the colon and are rarely present before the diagnosis is apparent.

11. The prognosis is good because metastasis takes place late. A diagnosis is made in many cases while still in the operable stage and constant anatomic relations lessen technical difficulties.

12. Operative mortality here is lower than in any other parts of the large intestine (10%).

Transverse Colon

1. The middle segment of the colon marks the transition of the character of the stool from liquid to solid.

2. Obstruction of some degree as the result of change in the character of the fecal content is usually found.

3. At the splenic end of the transverse colon, obstruction is present in almost 100% of cases.

4. Tumor is usually palpable and movable.

5. The tumor quite frequently is found attached to the greater curvature of the stomach and has the tendency to ulcerate into this viscus forming a fistula.

6. Constipation which has a tendency to increase and is associated with colic and distention is characteristic of carcinoma of the transverse colon. It is intermittent and moderate and when associated with indigestion and discomfort low in the abdomen, it is particularly significant. Such attacks of colic not infrequently are associated with vomiting especially if the tumor involves the stomach. The intermittent attacks of constipation with entire freedom of symptoms at comparatively long intervals constitutes one of the most significant features of malignancy of this

segment. Blood in the stool is more likely if the growth is in its distal half.

7. Operative mortality is highest in this segment regardless of the type of procedure used. The relatively rich and intermittently associated lymphatic drainage into the gastro-colic group of glands necessitates wide operative measures which are hazardous because of the frequent anomalies in the blood supply (mortality 24%).

8. The pathologic types of lesions common to both the right and left half of the colon are found in the middle segment.

Left Half

1. Obstruction is a predominant symptom, particularly if the tumor is near the splenic angle. The sequence of symptoms is mild attacks of discomfort associated with gas and colicky pains, moderate constipation, diarrhea, gradual obstruction, episodes of acute obstruction, final complete blockage.

2. Scirrhus carcinomas occur more frequently in this segment and have a tendency to encircle the bowel producing slow and progressive stenosis.

3. Tumefaction rarely is found in the descending colon above the sigmoid flexure. The splenic angle is situated so high under the ribs that it is impossible to palpate it and the anatomic conformities make it difficult to feel tumors of the descending colon.

4. Sensation of intestinal movements which ends at a given point will often be noted by the patient who can point out the definite site of the obstruction.

5. It is possible at times by palpation to force the passage of gas through this point of obstruction and to hear it gurgle as it is relieved.

6. Melena and tenesmus occur more frequently in left sided growths than elsewhere. Tenesmus is increasingly noted as the growth approaches the rectal sphincter. Blood in the stool or more frequently

on the stool depend on the type of growth and the amount of ulceration present.

7. More attention should be paid to indefinite symptoms. The most important diagnostic aid which can be employed in vague abdominal complaints is the roentgenogram.

8. Prognosis is less satisfactory because obstruction is more common, resection and union more difficult, complications more frequent and metastasis into adjacent lymph nodes takes place relatively sooner. Mortality (operative) here is approximately 17%.

Diagnosis

The difficulty of accurate diagnosis is enhanced by the fact that the colon is so frequently the site of other pathologic processes which resemble carcinoma: i.e., hyperplastic tuberculosis of the colon, segmental ulcerative colitis, actinomycosis, syphilis, diverticulitis, polyposis, abscess of the appendix, granuloma and occasionally carcinoma of the stomach. Retroperitoneal growths, such as lipomas in the region of the kidney, occasionally cause pressure and obstruction and must be ruled out before a diagnosis is reached.

X-ray Diagnosis

Unquestionably, the greatest advance in the diagnosis of diseases of the large bowel in the last decade has been in the hands of the roentgenologist. With adequate preparation and cooperation of the patient, the roentgenologist may by fluoroscopic examination and by supplementary evidence on roentgenograms correctly report the presence of lesions in a very high percentage of cases. An accurate roentgenologic diagnosis of from 95 to 97% of gastric or duodenal lesions is no longer looked on as unique. Such an accurate diagnosis can also be made when lesions involve the large bowel. The opaque enema is very strongly emphasized in contradistinction to the use of the oral meal.

Operability

Operability of carcinoma of the colon is determined by preoperative studies and by exploratory operations. The final opinion depends upon the presence of distant metastasis, lymphatic involvement, local attachment of the growth and on the resistance of the individual. Attachment of the lesion to the adjacent viscera influences to a marked degree, both mortality and recurrence. Hysterectomy in addition to a resection of the colon or a sleeve resection of the stomach together with removal of a segment of the transverse colon are formidable operations but may be indicated in certain cases. Anemia commonly associated with the right segment of the colon is not a contraindication to exploration and resection even though the concentration of the hemoglobin is low as 25 or 30%. If the patients are obese, the presence of dissection to even a mild degree makes the risk materially greater due to greater dangers of infection.

Surgical Therapy

Surgical therapy should be divided into three stages: (1) decompression, (2) rehabilitation, (3) resection. The first two stages are cooperative medico-surgical problems. Under this cooperative preoperative management, the Mayo Clinic group have brought the operability up to 58%. As previously stated, a large majority of cases show some degree of obstruction. Decompression, therefore, is a factor in nearly every case. Many of the patients are anemic, weak, dehydrated and the correction of these factors is a problem labeled as rehabilitation. Decompression is accomplished by a soft non-residue diet, mild purgation by fluid extract of senna and constant saline enemas. Even some subacute and acute cases have been decompressed in this manner. Complete obstructions must be decompressed by operative means (open or catheter types of ileostomy, cecostomy or appendicostomy). Individual preferences for methods and types seem innumerable. The extreme danger of manipulation due to infection to the bowel wall must be emphasized. Rehabilitation consists of blood transfusion, high fluid intake,

high caloric diet of low residue (fruit juice, eggs, butter, candy, rice), and the use of intraperitoneal vaccine. This is prepared from the peritoneal exudate of patients dying of peritonitis containing mixed streptococci and colon bacilli. It is administered three days before operation. A reaction usually follows manifested by malaise, headache and elevated temperature and pulse. This subsides in 24 hours. In 222 cases (Mayo Clinic) in which 11 deaths occurred from peritonitis, the mortality rate was approximately 5%. In 58 cases without vaccine, there were 13 deaths from peritonitis (22% mortality). Rankin feels that following the introduction of intraperitoneal vaccine he was able to reduce his mortality from 23% to approximately 12%. (Question is still open, i.e., vaccine or better technique?)

Choice of Operation

Several factors influence the choice of operation. Urgent emergency operations are indicated only by the presence of complete obstruction. A program permitting a return to normal physiologic equilibrium as nearly as possible and raising the threshold of safety even at the expense of increasing the time of treatment is most desirable. Unquestionably, in the majority of instances, multiple stage operation procedures can be carried out with safety over a period of 2 to 3 weeks. Probably greater advantage would be derived to a larger number of patients if a period of from 4 to 6 weeks were permitted to elapse between stages.

In the right half of the colon, an aseptic ileocolostomy between the terminal ileum and the transverse colon followed by resection of the right segment at the same stage or at a subsequent one, is the procedure of choice. Employment of an end to side anastomosis rather than a lateral anastomosis is recommended. With good preoperative management, approximately 50% of the cases may just as satisfactorily be operated upon in one stage as in two with approximately the same mortality rate. The procedure should be reserved for patients who constitute a better

surgical risk.

In the left half of the colon where obstruction is the most alarming symptom, the problem is different from that presented in the right half. If the obstruction is acute and the bowel is dilated, edematous and its tonicity lost, drainage by cecostomy or colostomy proximal to the growth is urgently indicated. Upon the other hand, as happens in a large percentage of cases, the obstruction is mild and is largely relieved by preoperative decompression, resection frequently may be accomplished in one stage. Primary anastomosis should never be carried on in the left half of the colon except in extremely rare instances. The procedure of choice is obstructive resection, the

Mikulicz type. Experience has proved that this procedure as originally described, has certain definite drawbacks, the most prominent of which is the likelihood of direct transplantation of malignant cells to the incision. It occurs in approximately 12% of the cases. Decompression procedures frequently allow for radical resection when the growth was previously believed to be irremovable. Lesions considered to be fixed to adjacent structures and inoperable because of extension will frequently be found following a decompression procedure to be readily resectable. The fixation often is due to inflammatory reaction rather than to an actual extension and invasion by carcinomatous lesions themselves.

End Results

End result reports are difficult to find. American follow-ups do not appear to have been published except in a few instances (?):

<u>Surgeon</u>	<u>No. Cases Surviving Resection</u>	<u>3 Yr. Survival %</u>	<u>5 Yrs. %</u>	<u>10 Yrs. %</u>	<u>15 to 20 Years %</u>
Finsterer	38	61	54	--	--
Porges	49	61	--	35	
Mikulicz	34	38	45	25	20
Turner	--	--	28	--	--

Konig and Dick gave end-results (44% operability):

<u>Years Since Operation</u>	<u>Number Total</u>	<u>No. Follow-up</u>	<u>Died Intercurrent Disease</u>	<u>Died Recurrence</u>	<u>Well</u>
13	30	6	6	6	7 (23%)
10	49	6	14	14	11 (22%)
7	58	6	19	19	14 (24%)
4	71	6	20	20	21 (30%)

No cases of recurrence observed after 3 years.

<u>Summary of results</u> in carcinoma of the right side of the colon:	<u>Cases</u>	<u>%</u>
Patients operated between 1919 and 1930 (Mayo Clinic)	150	
Complete data on	133	
Patients living	57	42.8
Deaths	76	57.2
Patients living more than 3 years after operation	62	47.0

<u>Postoperative period of life</u>	<u>Patients</u>
	<u>Living</u>
From 10 to 15 years	13
From 5 to 10 years	30
4 years	6
3 years	7
From 1 to 2 years	<u>11</u>
	57

<u>Postoperative period of life</u>	<u>Patients</u>
	<u>Dead</u>
1 month	23
2 to 12 months	32
From 1 to 2 years	14
3 to 5 years	<u>7</u>
	76

Left Half of colon (Mayo Clinic series)
493 cases.

	<u>Opera-</u>	<u>Hospital</u>	<u>Mortality</u>
	<u>tions</u>	<u>Cases</u>	<u>%</u>
<u>Total</u>	509	97	19.6
Resection	333	54	16.21
Palliative	100	31	31.0
Explorations	73	12	16.44

<u>Resections:</u>	<u>Cases</u>	<u>%</u>
Resections (all data)	288	74.5
Subsequent deaths	105	50.48
Living	103	49.51

Percentage of three year cures, 46.11%.

Summary

1. The problem in control of cancer of colon is not roentgenological or surgical but one of correct early diagnosis.

2. The colon is functionally and developmentally a bilateral organ. The right colon is part of the alimentary tract, the left part an excretory tract.

3. The difference in disease of the two sides depends on these functional differences.

4. Carcinoma of the large bowel comprises one-third of the gastro-intestinal malignancy group. The rectum is the seat

of one-half of these and the remainder are in the colon with preponderance in the two ends.

5. The only etiological factor known is the tendency of polypi to become malignant.

6. The types of carcinoma are scirrhus, polypoid and mucoid. Of these, the scirrhus is of the constricting type.

7. The microscopic grading of colonic cancers is not satisfactory at present.

8. Metastases are said to occur more readily as the location approaches the rectum. The local lymph nodes and liver are most frequently involved but any organ may be invaded.

9. In three independent series, 43%, 44% and 50% of cases of pathological material (autopsies and operative) were free of metastasis.

10. In general, the secondary pathological changes are toxicity (evidenced by anemia) in the right colon and progressive obstruction in the left.

11. Obstruction of some degree occurs in 80 to 90%, 5% of these are acute without previous symptoms. About one-third of the malignancies reach the third stage of acute obstruction.

12. The average hemoglobin of right sided lesions is 47%, of left sided lesions is 66%. On the right side, the anemia appears to be of toxic origin, on the left side it is due to bleeding.

13. The changes in blood chemistry due to obstruction itself are nearly always absent.

14. Peritonitis is the chief cause of death in all cases and is due to infection extending through the distended bowel wall. Actual rupture may take place.

15. Ninety percent of cases present symptoms for 6 to 8 months on the left side, and 12 months on the right side.

16. The early symptoms are notoriously vague. They may be divided into those of toxicity, of irritation by the tumor, and beginning partial obstruction.

17. Adequate investigations of these symptoms give a high percentage of correct diagnoses. Indefinite symptoms are passed by under other diagnoses. Medical treatment (soft diet, laxatives, etc.) relieve most of the early complaints.

18. X-ray diagnosis in experienced hands has reached a high degree of accuracy (up to 97%), even in the earliest lesions (polyps).

19. The surgical management consists of three stages: (1) decompression, (2) rehabilitation, and (3) resection. The first two are combined medico-surgical problems.

20. Operability (resection) under this method is high (50 to 60%), and equals the theoretical operability indicated by 40 to 50% presence of metastasis.

21. The outstanding danger in surgical technique is peritonitis mainly from migration of organisms through the bowel wall injured by distention.

22. Two developments appear to be significant: (1) the use of intraperitoneal vaccine (?), (2) multiple stage operation. By the use of the former, the mortality has been considerably reduced and by the latter has been reduced from 24 to approximately 10%.

23. The immediate mortality has shown a marked drop corresponding to development of technique. The best figures are those presented by the Mayo Clinic which are about 10%.

24. The operability has not changed much in the recent years excepting in certain clinics following the program quoted above.

25. Five year survivals are higher than in other types of gastro-intestinal malignancies.

26. General impression: Carcinoma of the colon can be diagnosed early but this

is not usually done because of the vagueness of symptoms. The average case has a much better chance of cure than many other malignancies (excepting skin).

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IV. CASE REPORTS - E. J. Semansky

1. CARCINOMA OF COLON (CECUM)

Male, Age 40, No.
Admissions - University of
Minnesota Hospitals

1-31-36 to 2-7-36 (O.P.D.)
2- 8-36 to 2-11-36
3-1-36 to 4- 5-36
6-4-36 to 6-20-36

Pain

1-1-35 - Attack of right lower quad-

rant crampy pain. No nausea or vomiting.
Three or 4 attacks up to present.

Diarrhoea

9- -35 - Severe diarrhoea. Bloody
stools. Side has ached ever since. Loss
of weight and strength.

Appendectomy

12- -35 - Laparotomy done. Carci-
noma of cecum found.

Past History

Unimportant. No severe illness up
to present.

Physical Examination

Well developed, well nourished white
male, age 40. The scar of the recent
laparotomy was observed in the abdominal
wall. There was a mass palpable in the
right lower quadrant which was somewhat
tender to pressure.

X-ray Examination

Extensive defect at the base of the
cecum which was somewhat irregular.
There was very little barium passing
through the ileocecal valve. The de-
formity at the base of the cecum sug-
gested a retrograde intussusception of
the ileum as a result of the tumor.
Diagnosis was carcinoma of the cecum
with secondary intussusception. A
chest ray showed no disease.

Laboratory

Urine was essentially negative.
Hemoglobin 85%, red count 4,950,000,
white count 9,600. Blood Wassermann
negative. The stool was negative for
occult blood on a single examination.

Cold

Admitted to hospital 2-8-36, but
developed an upper respiratory infec-
tion which prevented immediate operation.
Discharged on 2-11-36, with instructions
to return when he had recovered from
this infection.

Operation

Readmitted 3-1-36 and on 3-2-36
laparotomy was carried out under spinal
anesthesia supplemented with gas inhala-
tion. The former incision in the right
rectus region was reopened. There were
some adhesions of the omentum at the

site of the scar. The small bowel was adherent to the peritoneum to the right of the scar over a small area. The tumor in the cecum was about $2\frac{1}{2}$ inches in diameter, and it was stuck to the lateral abdominal peritoneum but not infiltrating the wall. The peritoneum lateral to the cecum was cut along the right side of the abdominal wall in the cecum. The terminal ileum and the entire ascending colon were reflected medially. The ileum was then cut across about six inches above the ileocecal valve between Payr clamps. The mesentery was then removed down to the root of the mesentery of the small bowel and up to the hepatic flexure of the colon. All of the mesentery in the ileocecal angle was removed. The colon was then freed up to the left of the hepatic flexure, and sectioned between Payr clamps with cautery. The tumor was then removed. The end of the ileum and the cut end of the colon were then sutured together so that the mesentery would not come between them when the clamps were applied, and they were brought out through the upper third of the abdominal incision. The ileum was left long, and an enterostomy tube was inserted in it after it has brought out of the abdominal wall.

Pathological examination

Tumor mass measuring 7x5 cm. extending throughout the entire thickness of the bowel, but not invading the serosa. Microscopic examination revealed adenocarcinoma of the cecum.

Convalescence

Uneventful, and on 3-25-36 a large hysterectomy clamp was placed on the colostomy spur. The clamp was then tightened one notch daily until it cut through the spur and fell off on 3-31-36. Discharged on 4-5-36, and given an appointment to return for readmission at a later date, at which time closure of the colostomy will be undertaken.

Closure

The ileum and colon were dissected free from the abdominal wall, exposing the peritoneal surface all around the circumference of the loop. At one point an opening was made through the adhesions into the peritoneal cavity. Elsewhere the operation was entirely extraperitoneal.

Following this freeing of the loop, the anastomosis was completed by end to end suture of the ununited side. The lumen following this closure was about 1 inch or slightly less in diameter. Abdomen was then closed in layers. The layers were first dissected free so that they were identified and then closed after this to each other.

Discharged

6-20-36. Apparently well. Gained weight and strength.

2. CARCINOMA OF COLON (HEPATIC FLEXURE)

- Male - Age 27 years.
No. University of Minnesota
Hospitals 3-30-32 to 4-2-32.

Abdominal Attack

6- -31 - Vomiting, diarrhoea, weakness. Lasted about 3 weeks. No pain. This was followed by heavy feeling and gas in abdomen.

Pain

2-1-32 - Gradually developed pain in right lower quadrant which radiated to left lower, not to back. Pain starts about 10 minutes after eating and lasts about 2 or 3 hours. Doubles him up at times. Greasy foods and spices make it worse. Pain disturbs sleep and does not permit him to work. Weight loss - 28 lbs. Stools normal. No constipation.

Physical Examination

Mass in right upper quadrant which moves with respiration. Rigidity over entire abdomen. No rebound tenderness. Pale and evidence of weight loss.

Laboratory

Urine negative. Hemoglobin 82%.
Erythrocytes 4.6 - Leucocytes 14.2
Blood Wassermann negative.

Roentgen Studies

Gall bladder normal.

Colon Barium Enema

Given. Colon filled out well until

the barium reached hepatic flexure. At this point some resistance was met and it was possible only to get a small amount beyond because of the inability of the patient to retain the enema. The plate following the enema showed a definite stricture at this point with some irregularity but not sufficient to make a diagnosis. Barium was given by mouth and followed thru. At 24 hours it showed a definite ragged filling defect in the hepatic flexure of the colon quite characteristic of a carcinoma. There was a fair amount of barium that had gone around the descending colon and the rectum, but there was definite evidence of some obstruction with stasis in the caecum.

Conclusions

Carcinoma of hepatic flexure of colon which is not obstructing completely.

Operation

Done by our own surgeon at another hospital. Apparently in 2 stages. Wound never healed. Advised to come here for X-ray therapy.

3-23-33 - Biopsy of wound shows gelatinous adenocarcinoma. X-ray therapy advised.

Follow-Up

5-11-33 - Failed appointment.

3. CARCINOMA OF COLON (TRANSVERSE)

. - Female - Age 65.
No. Admission to University of Minnesota Hospitals
Sept. 1932.

Chief Complaint

Attacks of abdominal pain, situated in region of umbilicus for approximately 7 months.

Pain

Crampy and colicky. Occurred about once every two weeks. Associated with gurgling noises in abdomen and presence of a "lump" near the umbilicus during the attacks. Lump would disappear after pain subsided. Occasionally had slight abdominal distension and nausea and

vomiting during attacks. (No weight loss). Attacks became more severe up to and including her hospital admission. Pain not relieved by cathartics or enemas. No history of rectal bleeding. Attack of pain day prior to admission most severe.

Past History

Hysterectomy for carcinoma of uterus.

Physical Examination

Negative except for slight abdominal distension. Suggestion of a palpable mass near umbilicus. Decompressed by conservative measures (nasal suction, etc.).

Laboratory

Hemoglobin 92%. Leucocytes 7,550, neutrophils 80%, Lymphocytes 20%.
Urine - Trace of albumin.

X-ray Examination

Stomach and duodenum are normal. There is some delay after entrance of barium into the caecum but at 24 hours the meal has passed into the descending colon. There is a definite constriction in the mid-portion of the transverse colon just over the spine which is slightly irregular and characteristic of an annular carcinoma. The obstruction is incomplete as the enema could be passed well into the caecum. Conclusions: Carcinoma of transverse colon.

Treatment

Mikulicz resection of transverse colon 9-16-32. (Pathological Diagnosis - adeno-carcinoma Grade III). One year later recurrence of carcinoma about colostomy in abdominal wall. Given deep x-ray therapy and radium implanted about site of recurrence.
Expired Jan. 1934.

4. CARCINOMA OF COLON (RECTO-SIGMOID)

G.W. - Age 68. No. 621847.
Admitted to University of Minnesota Hospitals January 1928.

Diarrhoea

History of diarrhoea for one and one half years (20 to 30 stools a day), associated with weight and strength loss. Frequently had frank bleeding from rectum.

Physical Examination

Negative except for presence of palpable tumor mass on rectal examination (7 cm's from anal orifice).

Laboratory

Erythrocytes 3,250,000. Hemoglobin 61%. Stool examination: gross blood - occult blood positive by Guaiac test.

X-ray Findings

Fluoroscopic and plate examination of the colon was made with a barium enema. The rectal ampulla filled well but there was a marked constriction at the junction between the rectum and sigmoid. The distal portion of the sigmoid showed a marked irregular narrowing with a distinct filling defect. Remainder of colon not visualized because of large amounts of feces in it.

Conclusions: Carcinoma of sigmoid at recto-sigmoid junction.

Operation

Inguinal colostomy February 1928.
Posterior resection of rectum
March 1928.

Follow-up

October, 1933. Alive and well. No evidence of return of growth.
November, 1934 - Failed appointment.
December 6, 1934 - Not feeling well. Often constipated. Small amount of blood with each bowel movement.